

We claim:

1. A method for generating an aerosol, the method which comprises:

guiding a gas having input particles suspended therein and flowing at a supersonic velocity such that a compression shock occurs in the gas; and

breaking the input particles into output particles being smaller than the input particles by passing the input particles through the compression shock.

2. The method according to claim 1, which comprises guiding the gas in an enclosure having a cross-section widening in a direction of flow in order to achieve the supersonic velocity.

3. The method according to claim 2, which comprises providing the enclosure such that, as seen in the direction of flow, the cross-section of the enclosure narrows prior to widening in order to achieve a sonic velocity.

4. The method according to claim 2, which comprises guiding the gas such that the compression shock occurs, as seen in the direction of flow, before an end of the enclosure and thus inside the enclosure.

5. The method according to claim 2, which comprises guiding the gas such that the compression shock occurs at a point located substantially  $2/3$  of a distance along a length of a widening portion of the enclosure following a narrowest cross-section of the enclosure in the flow direction.

6. The method according to claim 2, which comprises guiding the gas such that the compression shock occurs, as seen in the direction of flow, behind an end of the enclosure and thus outside the enclosure.

7. The method according to claim 1, which comprises feeding the input particles to the gas while the gas is at rest.

8. The method according to claim 1, which comprises feeding the input particles to the gas while the gas flows at subsonic velocity.

9. The method according to claim 1, which comprises:

providing the enclosure with a narrowing cross-section upstream of a widening cross-section as seen in a direction of flow; and

providing the gas such that a pressure of the gas in a resting state upstream of the narrowing cross-section is between  $1 \cdot 10^5$  Pa and  $2.5 \cdot 10^7$  Pa.

10. The method according to claim 1, which comprises:

providing the enclosure with a narrowing cross-section upstream of a widening cross-section as seen in a direction of flow; and

providing the gas such that a pressure of the gas in a resting state upstream of the narrowing cross-section is between  $2 \cdot 10^5$  Pa and  $2 \cdot 10^6$  Pa.

11. The method according to claim 1, which comprises:

providing the enclosure with a narrowing cross-section upstream of a widening cross-section as seen in a direction of flow; and

providing the gas such that a pressure of the gas in a resting state upstream of the narrowing cross-section is between  $3 \cdot 10^5$  Pa and  $1 \cdot 10^6$  Pa.

12. The method according to claim 1, which comprises:

providing the enclosure with a narrowing cross-section upstream of a widening cross-section as seen in a direction of flow; and

providing the gas such that a pressure of the gas in a resting state upstream of the narrowing cross-section is substantially  $5 \cdot 10^5$  Pa.

13. The method according to claim 1, which comprises:

providing the enclosure with a narrowing cross-section upstream of a widening cross-section as seen in a direction of flow; and

providing the gas such that a temperature of the gas in a resting state upstream of the narrowing cross-section is between  $-20^{\circ}\text{C}$  and  $400^{\circ}\text{C}$ .

14. The method according to claim 1, which comprises:

providing the enclosure with a narrowing cross-section upstream of a widening cross-section as seen in a direction of flow; and

providing the gas such that a temperature of the gas in a resting state upstream of the narrowing cross-section is between 0°C and 50°C.

15. The method according to claim 1, which comprises:

providing the enclosure with a narrowing cross-section upstream of a widening cross-section as seen in a direction of flow; and

providing the gas such that a temperature of the gas in a resting state upstream of the narrowing cross-section is between 10°C and 30°C.

16. The method according to claim 1, which comprises:

providing the enclosure with a narrowing cross-section upstream of a widening cross-section as seen in a direction of flow; and

providing the gas such that a temperature of the gas in a resting state upstream of the narrowing cross-section is between 20°C and 25°C.

17. The method according to claim 1, which comprises

providing the gas such that the gas includes at least one

element selected from the group consisting of air, N<sub>2</sub>, O<sub>2</sub>, and CO<sub>2</sub>.

18. The method according to claim 1, which comprises providing the input particles such that an average size of the input particles is between 20  $\mu\text{m}$  and 200  $\mu\text{m}$ .

19. The method according to claim 1, which comprises providing the input particles such that an average size of the input particles is between 40  $\mu\text{m}$  and 100  $\mu\text{m}$ .

20. The method according to claim 1, which comprises providing the input particles such that an average size of the input particles is between 45  $\mu\text{m}$  and 60  $\mu\text{m}$ .

21. The method according to claim 1, which comprises providing the output particles such that an average size of the output particles is between 1  $\mu\text{m}$  and 10  $\mu\text{m}$ .

22. The method according to claim 1, which comprises providing the output particles such that an average size of the output particles is between 2  $\mu\text{m}$  and 5  $\mu\text{m}$ .

23. The method according to claim 1, which comprises providing the output particles such that an average size of the output particles is substantially 3  $\mu\text{m}$ .

24. The method according to claim 1, which comprises providing the input particles as droplets of a liquid.

25. The method according to claim 24, which comprises providing water as the liquid.

26. The method according to claim 24, which comprises providing the liquid as a carrier liquid for an agent.

27. The method according to claim 26, which comprises providing the agent as a pharmacologically active agent.

28. The method according to claim 26, which comprises providing the agent as a pharmacologically active inhalation therapy agent.

29. The method according to claim 26, which comprises providing a solvent as the liquid.

30. The method according to claim 29, which comprises providing an alcohol as the solvent.

31. The method according to claim 24, which comprises providing a combustible liquid as the liquid.

32. The method according to claim 31, which comprises providing a fuel as the combustible liquid.

33. The method according to claim 1, which comprises providing at least some of the input particles as loosely linked particles selected from the group consisting of solid particles and semi-solid particles.

34. A device for generating an aerosol, comprising:

a gas guiding device configured to guide a gas having input particles suspended therein and flowing at a supersonic velocity; and

said gas guiding device being configured to generate a compression shock in the gas such that the input particles, upon crossing the compression shock, are broken down into output particles smaller than the input particles.

35. The device according to claim 34, wherein said gas guiding device includes an enclosure defining a flow direction, said enclosure guides the gas along the flow direction, said enclosure has a first portion with a narrowest cross-section and a second portion disposed after said first portion as seen in the flow direction, said second portion has a cross-section expanding along the flow direction.



36. The device according to claim 35, wherein said enclosure includes a third portion disposed upstream of said first portion as seen in the flow direction, said third portion has a cross-section narrowing along the flow direction.

37. The device according to claim 34, wherein said gas guiding device is a Laval nozzle.

38. The device according to claim 37, wherein said Laval nozzle is an unmatched Laval nozzle.

39. The device according to claim 34, including a supply device connected to said gas guiding device, said supply device supplying the input particles.

40. The device according to claim 39, wherein said supply device is an atomizer.

41. The device according to claim 35, including a supply device for supplying the input particles, said supply device being disposed upstream of said narrowest cross-section of said first portion of said enclosure.

42. The device according to claim 36, including a supply device for supplying the input particles, said supply device

being disposed upstream of said cross-section of said third portion narrowing along the flow direction.

43. The device according to claim 34, including a gas supply device connected to said gas guiding device for providing pressurized gas.

44. The device according to claim 43, wherein said gas supply device is a storage tank.

45. The device according to claim 43, wherein said gas supply device is a pump.

46. The device according to claim 36, wherein said enclosure is configured such that the gas has a pressure between  $1 \cdot 10^5$  Pa and  $2.5 \cdot 10^7$  Pa in a resting state upstream of said cross-section of said third portion of said gas guiding device narrowing along the flow direction.

47. The device according to claim 36, wherein said enclosure is configured such that the gas has a pressure between  $2 \cdot 10^5$  Pa and  $2 \cdot 10^6$  Pa in a resting state upstream of said cross-section of said third portion of said gas guiding device narrowing along the flow direction.

48. The device according to claim 36, wherein said enclosure is configured such that the gas has a pressure between  $3 \cdot 10^5$  Pa and  $1 \cdot 10^6$  Pa in a resting state upstream of said cross-section of said third portion of said gas guiding device narrowing along the flow direction.

49. The device according to claim 36, wherein said enclosure is configured such that the gas has a pressure of substantially  $5 \cdot 10^5$  Pa in a resting state upstream of said cross-section of said third portion of said gas guiding device narrowing along the flow direction.

50. The device according to claim 36, wherein said enclosure is configured such that the gas has a temperature between  $-20^\circ\text{C}$  and  $400^\circ\text{C}$  in a resting state upstream of said cross-section of said third portion of said gas guiding device narrowing along the flow direction.

51. The device according to claim 36, wherein said enclosure is configured such that the gas has a temperature between  $0^\circ\text{C}$  and  $50^\circ\text{C}$  in a resting state upstream of said cross-section of said third portion of said gas guiding device narrowing along the flow direction.

52. The device according to claim 36, wherein said enclosure is configured such that the gas has a temperature between  $10^\circ\text{C}$

and 30°C in a resting state upstream of said cross-section of said third portion of said gas guiding device narrowing along the flow direction.

53. The device according to claim 36, wherein said enclosure is configured such that the gas has a temperature between 20°C and 25°C in a resting state upstream of said cross-section of said third portion of said gas guiding device narrowing along the flow direction.

54. The device according to claim 43, wherein said gas supply device provides at least one gas selected from the group consisting of air, N<sub>2</sub>, O<sub>2</sub>, and CO<sub>2</sub>.

55. The device according to claim 41, wherein said supply device is configured to supply input particles having an average size between 20 μm and 200 μm.

56. The device according to claim 41, wherein said supply device is configured to supply input particles having an average size between 40 μm and 100 μm.

57. The device according to claim 41, wherein said supply device is configured to supply input particles having an average size between 45 μm and 60 μm.

58. The device according to claim 34, wherein said gas guiding device is configured to provide output particles having an average size between 1  $\mu\text{m}$  and 10  $\mu\text{m}$ .

59. The device according to claim 34, wherein said gas guiding device is configured to provide output particles having an average size between 2  $\mu\text{m}$  and 5  $\mu\text{m}$ .

60. The device according to claim 34, wherein said gas guiding device is configured to provide output particles having an average size of substantially 3  $\mu\text{m}$ .

61. The device according to claim 41, wherein said supply device is configured to supply liquid droplets as the input particles.